

Using fuzzy logic to enhance audit procedures

Ikram Abdel Wahab Jabbar (1),

(1) Master. Student. Faculty of Administration and Economics, Department of Accounting / University of Kufa, Najaf, Iraq. bd232983@gmail.com (1)

Assist. Prof. Dr Yasir Sahib Malik (2)

(2) Faculty of Administration and Economics, Department of Accounting / University of Kufa, Najaf, Iraq. yasirs.abdali@uokufa.edu.iq (2)

ABSTRACT

The aim of the research is to employ one of the important techniques of artificial intelligence, which is fuzzy logic in the field of auditing, and to explore how to benefit from this technology in enhancing auditing procedures. This questionnaire consisted of (50) questions and two axes, the first axis is dedicated to measuring audit procedures and includes three dimensions, and the second axis is dedicated to measuring fuzzy logic, and the five-point Likert scale was used. The results showed that there is a direct effect between each paragraph and the dimension to which it belongs.

Keywords:

fuzzy logic, audit procedures

Introduction

One of the main reasons that led to the emergence of auditing is the separation of ownership from management, as this is a cause of concern for the owners of capital, so they began to search for a way to be assured of their money and the progress of their business activity, and this led to the emergence of auditing, and usually the auditor uses classical logic when expressing his opinion on the correctness and fairness of the lists Financial, classical logic depends on right or wrong, existence or non-existence, i.e. the results contain a wide range of possibilities, so one of the techniques of artificial intelligence, which is fuzzy logic, was resorted to in order to reach more accurate results and explore how to benefit from this technology in enhancing audit procedures and the need to raise awareness Units to develop and progress and rely on what is new and move away from the traditional side.

Research problem

The main problem of the research is that the auditor who provides the neutral technical opinion about the fairness and soundness of the presented financial statements takes or practices many traditional procedures to reach that opinion, and the logic used in those procedures is usually the classical logic based on specific options related to existence or non-existence, due to availability and unavailability, and these options are reached in light of a wide range of possibilities that may be inaccurate, so one of the techniques of artificial intelligence was resorted to, which is (fuzzy logic), which has the ability to simulate human thinking and reach more accurate results

From here, the research problem can be formulated according to the following questions:

1- Is there a relationship between the use of fuzzy logic and the audit procedures of correlation and preliminary planning?

2- Is there a relationship between the use of fuzzy logic and the audit procedures represented in evaluating the internal control system?

3- Is there a relationship between the use of fuzzy logic and the audit procedures represented in preparing the audit report?

4- Can fuzzy logic, as one of the techniques of artificial intelligence, contribute to enhancing audit procedures?

Research importance

The importance of the research lies in the attempt to apply one of the techniques of artificial intelligence, which is (fuzzy logic), in order to enhance the audit procedures to reach more accurate results compared to using classical logic, and also because of the development in the activities of the units and the multiplicity of their objectives. The research derives its importance through the increasing burdens placed on the auditor and duties. What is required to be done, which made the auditor the focus of attention of many related parties.

The importance of the research can be stated through two axes:

First: Scientific importance: The use of fuzzy logic in enhancing audit procedures, which is one of the techniques of artificial intelligence, can contribute to obtaining a neutral technical opinion for the auditor in the fairness of the presented financial statements and the management of economic units, and is considered an important update for the procedures practiced by auditors in this field.

Second: - Practical importance: This is done through application in (Directorate of the Office of Financial Supervision in Najaf Al-Ashraf / research sample) affiliated to the Federal Office of Financial Supervision, and it is thus an appropriate environment for applying the fuzzy logic method (which is one of the methods of artificial intelligence) to enhance audit procedures.

Research aims

According to the questions that were raised for the research problem, the current research mainly aims to achieve a set of goals, which are as follows:

1- The research aims to employ one of the important techniques of artificial intelligence, which is fuzzy logic in the field of auditing.

2- Exploring how to take advantage of this technology to enhance audit procedures.

3- Shedding light on the role of one of the techniques of artificial intelligence (fuzzy logic) and the need to take care of it and try to use it and benefit from it as much as possible.

4- The need to educate institutions on development and progress, relying on what is new, moving away from the traditional, classic side, and heading towards what is modern and new.

Research assumes

Based on the problem of the study and to achieve its objectives, it is based on the following hypotheses:

The main hypothesis: - There is a statistically significant effect relationship between the use of fuzzy logic and audit procedures, and this hypothesis is divided into the following sub-hypotheses: -

1- There is a statistically significant effect relationship between the use of fuzzy logic and audit procedures represented by correlation and preliminary planning.

2- There is a statistically significant effect relationship between the use of fuzzy logic and the audit procedures represented in evaluating the internal control system.

3- There is a statistically significant effect relationship between the use of fuzzy logic and the audit procedures represented in preparing the audit report.

Research limits

The research limits are:

The spatial limits of the research: The spatial limits of the research are in the Federal Office of Financial Supervision and the sample (Directorate of the Office of Financial Supervision in Al-Najaf / located in Al-Najaf Governorate) for the purpose of applying the practical side in it.

The temporal limits of the research: The temporal limits of the research are during the 2021-2022 season.

Fuzzy logic

Fuzzy logic has been used in commercial and industrial business, engineering, medical

sciences, mathematics, and others, as its effect is clear in saving energy as well as saving time and cost, as well as it has been used in smart problem-solving applications.

The origin of fuzzy logic:

The first to innovate the idea of fuzzy logic in the year 1965 is Professor (Zadeh) from the University of California at (Berkeley), but it did not receive good attention until Dr. Mamdani applied a practical application of fuzzy logic in an automatic steam engine and he is a professor at the University of London, ten years after the invention of the fuzzy theory Years Ali, et.al, 2015: 76)) fuzzyLogic appeared to fill many gaps in classical logic, Classical Logi, as the latter depends on clear and specific quantitative rules, meaning that the variable in it takes either 0 or 1, i.e. true or false, and there is no region Gray or fuzzy between 0 and 1, while fuzzy logic is completely different as it is multi-valued and has many gray and fuzzy areas (Al-Shabasi, 2020: 75-76).

The concept of fuzzy logic:

One of the most important applications of artificial intelligence is the fuzzy logic technique, as it seeks to formalize ways of thinking that are usually inaccurate, as it is closer to human thinking than classical logic and has a role in helping decision-making under conditions of uncertainty that are characterized by lack of information. And its ambiguity, that the various variables, whether quantitative or linguistic, the fuzzy logic is able to deal with them for the purpose of providing clear results free of ambiguity (Sulaiman & Ismail, 2019: 886)) fuzzy logic has two different meanings in the concept, a concept in the broad sense and a concept in the narrow sense, the concept In the broad sense, it is synonymous with the theory of fuzzy groups, which is usually related to categories of organisms with boundaries in which membership is a matter of degree, while the concept in the narrow sense is an extension of multi-value logic (SHAIKSHAVALI, 2020: 179)) Fuzzy logic is an accurate approach to solving problems, as it has the ability to Dealing simultaneously with numerical data and linguistic variables without the need for much complex mathematical description, that classical logic does not have the ability to deal

with vague ideas, while logic A fuzzy contributes to assisting computers in identifying differences between data that are similar to the logical thinking process of the human brain, not only in identifying alternatives in black and white, but in identifying the infinite gradations between them, as fuzzy logic puts numbers or values for these gradations in order to get rid of ambiguity in Classical logic, as these numbers or values contribute to finding accurate solutions to the complex system (Ouyelowe, et.al, 2021: 367)

Reason for using fuzzy logic:

There are several reasons that were the main motive for the use of fuzzy logic. Some of them will be addressed: - Chung, 2020: 8)

- 1- The human ability to solve complex problems in an inaccurate environment contributed to the development of fuzzy logic.
- 2- In an environment where information may be fuzzy or missing, a person uses inference for the purpose of making decisions quickly and efficiently.
- 3- It contains many linguistic terms that most people usually have an idea about, but the correct and accurate meaning of it is open to people's interpretation.
- 4- In an imperfect environment, fuzzy logic enables systems to deal with imprecise thinking, which is important in making effective decisions.

The difference between fuzzy logic and traditional (classical) logic:

Some differences between fuzzy logic and classical logic will be addressed:- (Grace, et.al, 2022: 2)

- A- Fuzzy logic is based on decisions of truth in a similar way to the way the human brain works, while classical logic is based on probability theory.
- B- Based on uncertainty or probabilities, fuzzy logic provides flexibility in decision-making, while classical logic is limited to 0 or 1.
- C - Fuzzy logic has the ability to compute and think through the use of information based on perception, while classical logic does not have the ability to do so.
- D- Fuzzy logic can imitate the human mind and imitate previous experiences for the purpose of achieving the best results, while classical logic cannot.

E- Fuzzy logic can provide a good way to design a simulation based on a variety of variable inputs that control the development of a proposed model, while classical logic does not.

The main characteristics of fuzzy logic:

Fuzzy logic is characterized by major characteristics that will be addressed: - (Iqbal & Sang, 2021: 3))

- 1-Everything has a degree of belonging in fuzzy logic.
- 2- Every classical system can be modeled in fuzzy logic.
- 3- In fuzzy logic, knowledge can be translated as a set of variables
4. The conclusion can be presented to an expanded set of flexible conditions as a logical processing.
- 5- Fuzzy logic is characterized by flexibility and ease of understanding.
- 6- Fuzzy logic can model nonlinear systems.
- 7- Fuzzy logic designs based on human experience.

Characteristics of fuzzy logic:

Fuzzy logic has many characteristics that make it an alternative to classical logic and a good choice for use: (Belharizi and Ibn Masoud, 2020: 128), (Prabu, et.aI, 2020: 1), (Cheng, 2022: 5).

- 1- Fuzzy logic supports uncertain data because it is theoretically easy to understand.
- 2- Fuzzy logic is flexible with any system, as it is easy to modify it and add more functions over it without going back to zero again.
- 3- Fuzzy logic is based on the expression of human language.
- 4- It is possible to build fuzzy logic based on the expertise and experiences of experts in certain fields.
- 5- It is possible to create a fuzzy system to match any set of input and output data, due to the presence of functions for non-linear models, a detailed stronghold for the purpose of obtaining proofs and evidence that help him express a neutral technical opinion on the validity and fairness of the financial statements, and it can be said that the audit procedures are the functions he performs The external auditor, in order to achieve the objectives of the audit, in this axis these procedures will be discussed, as well as the evidentiary evidence, its characteristics, the

factors affecting it, and the difficulties in obtaining it.

What are the audit procedures:

The audit procedures are among the methods used by the auditor for the purposes of obtaining evidence and evidence, and some of these procedures will be addressed:- (Rashid, 2017: 18)

A - Inspection: It means the examination of external or internal documents and records in electronic form, paper form or any other media, as well as the use of physical examination in the event of an examination of an asset.

B - Observation: It means examining and observing the actions of others.

C - External Confirmation: It means that the evidence obtained by the external auditor sometimes may need confirmation from other parties.

E - Recalculation: It means verifying the records and documents that are examined from the mathematical point of view.

E - Re-performance.

F - Analytical procedures: It is intended to evaluate the financial information in the financial statements.

G - Inquiry: It means inquiring from people with financial and non-financial experience and knowledge, whether these people are from outside the institution or from within it.

According to (Rehab and Mahri, 2021: 9-11), the means of obtaining evidence are as follows:

1- The actual inventory: The auditor performs the actual inventory to verify the physical presence of the tangible and tangible elements of the institution's assets, as well as checking the book balance and comparing it with the actual balance, and the actual inventory is not evidence of the institution's ownership.

2- Arithmetic operations: It is considered one of the strong proofs of evidence, because the auditor is the one who performs it himself, and it represents a group of operations that the auditor or one of his assistants performs to verify the validity of the totals and results.

3- Documentary review: The documentary audit is the main focus of the audit process, as the auditor spends most of the time in collecting such evidence, and the auditor, when conducting the documentary audit, must verify

that the document is legally, objectively and formally correct, and has the signature of those who have the authority to sign.

4- Authentications: They are considered as certificates sent to the auditor by third parties related to confirming the correctness of their accounts. They are of three types: positive authentications, negative authentications, and blind authentications.

5- Inquiry: This method is one of the means of obtaining evidentiary evidence by its subjective nature and depends a lot on the auditor's interpretation and personal judgment.

6 - Analytical procedures: It represents a set of tests carried out by the auditor as he studies the relationship between financial information and non-financial information and the comparison of the current year with the previous year.

7 - Examination and critical review: This method of obtaining evidence is considered a tool of criticism and analytical examination by checking one of the accounting records or one of the entries, and this method requires the availability of high experience and skill.

8- The internal control system: The auditor must examine and evaluate the internal control system and determine the extent of reliance on

it. If there is an integrated, strong and effective internal control system, this will reassure the auditor.

9 - Certificates and declarations within the institution: - This includes the auditor obtaining written answers to the questions and information required to be obtained, which were raised during the official meetings.

Description of the research sample:

The research community represented by the employees of the Bureau of Financial Supervision in Najaf was identified because it is responsible for controlling and auditing all state departments that are funded from the state's general budget, public sector companies, mixed sector companies, and government self-financing departments. (100) questionnaires were distributed to the employees of the Bureau of Financial Supervision in Najaf. Al-Ashraf, and the valid forms for statistical analysis were (87) forms.

Results of testing research hypotheses

For the purpose of providing data appropriately to test hypotheses, the researcher coded the data for the purpose of entering it into the statistical program used, as follows:

Table No. (1) Coding the research variables

NO	Variable name	variable type	coding
1	Fuzzy logic	independent	FIOG
2	audit procedures	master follower	AP
3	Audit procedures of engagement and initial planning	child function	P&PP
4	Audit procedures represented in evaluating the internal control system	child function	ICSE
5	Audit procedures represented in the preparation of the audit report	child function	POAR

The first hypothesis: - "There is a statistically significant effect of using fuzzy logic in auditing procedures."

To test this hypothesis, the following "linear regression" model was formulated:

$$AP = B_0 + B_1 FLOG + \varepsilon \text{ where:-}$$

ε = errors of estimation.

B_0 = constant of the regression equation, which represents the value of the dependent variable when the value of the independent variable is equal to zero.

B_1 = slope of the regression function, which measures the effect of the independent variable on the dependent variable.

And using the SPSS statistical program, the results were as follows:

Table No. (2) summary of the main hypothesis testing form

Model Summary ^b				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.463 ^a	.214	.205	.39513
a. Predictors: (Constant), FIOG				
b. Dependent Variable: AP				

The above table shows a model summary that the value of the correlation (R) between the variables amounted to 0.463, which is a value of medium strength, and that the coefficient of determination R Square was 0.214, which represents the "explanatory power" of the model used. That is, the independent variable

(fuzzy logic) explains its value 21.4 % of the dependent variable (auditing procedures), and that the standard deviation of the Estimate Error was 39513.0, which is a very low number, and the lower this type of error, the better it is statistically.

Table No. (3) Variation of testing the main hypothesis

ANOVA						
Model		Sum of Squares	df	Mean Square	F	Sig.
	Residual	13.271	85	.156		
1	Regression	3.612	1	3.612	23.137	

The table above shows the above variation anova that the calculated value of F amounted to 23.137 which is greater than its tabular value calculated according to degrees of freedom df (85.1) which amounts to 3.98 at the level of significance of 5%. The level of significance of

the Sig test amounted to 0.000 which is less than the value of acceptable error in science predetermined by 0.05, which indicates the suitability of the statistical model used to test the hypothesis.

Table (4) coefficients of the regression function for the main hypothesis

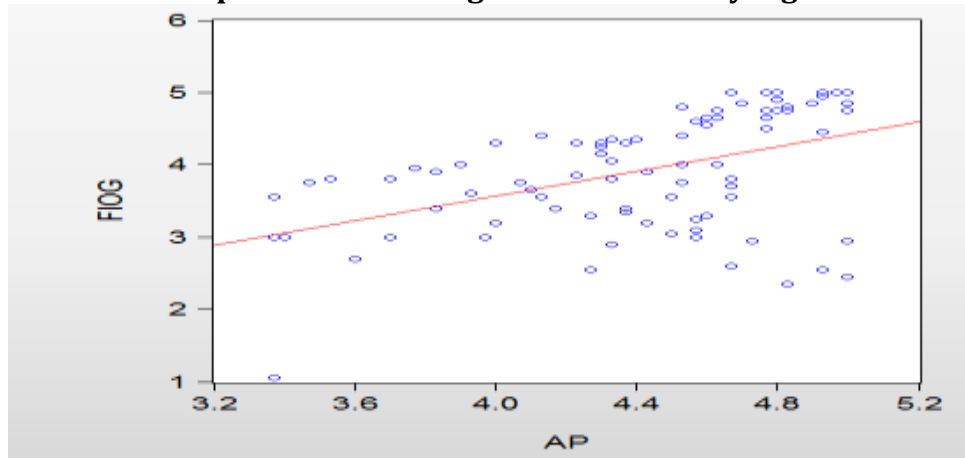
Coefficients						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.437	.209		16.472	.000
	FIOG	.250	.052	.463	4.810	.000

The table of coefficients of the regression function shows that the value of the constant of the regression equation was 3.437, and that the value of the slope of the regression equation was 0.250, which shows the effect of the independent variable on the dependent variable (through coefficient B), and the positive value of the coefficient indicates that there is a direct effect between the dependent and independent variables, or in the words Also, any increase in the independent variable (using fuzzy logic) by one degree leads to an increase of 25% in the dependent variable (audit procedures) with all other independent variables remaining

constant. It is also noted from the table above that the level of significance of the T-statistic for the independent variable amounted to 0.00, which is Much less than the pre-determined accepted error in social sciences of 0.05, and this means that the sample data has provided convincing evidence to accept the research hypothesis to prove the effect statistically.

The following figure confirms the relationship between the two variables through the shape of the spread, as the upward trend of the curve indicates the direct relationship between the degree of use of fuzzy logic and audit procedures.

Figure (1) The relationship between the degree of use of fuzzy logic and audit procedures.

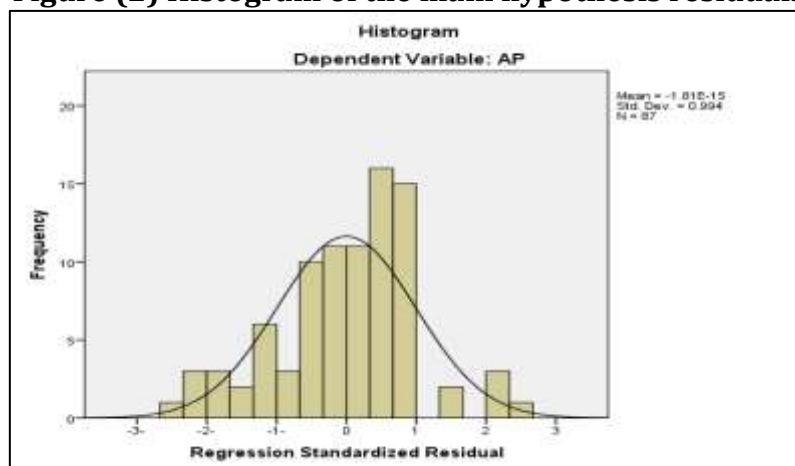


The regression equation that was adopted in testing the hypothesis can be reformulated in the light of the results that have been reached, which can be used for the purpose of prediction in the following way:

$$AP = 3.437 + 0.25 * FLOG$$

The following figure displays the frequency histogram, which shows the normal distribution of the statistical residuals of the regression equation, which shows the accuracy of the previous regression equation.

Figure (2) Histogram of the main hypothesis residuals

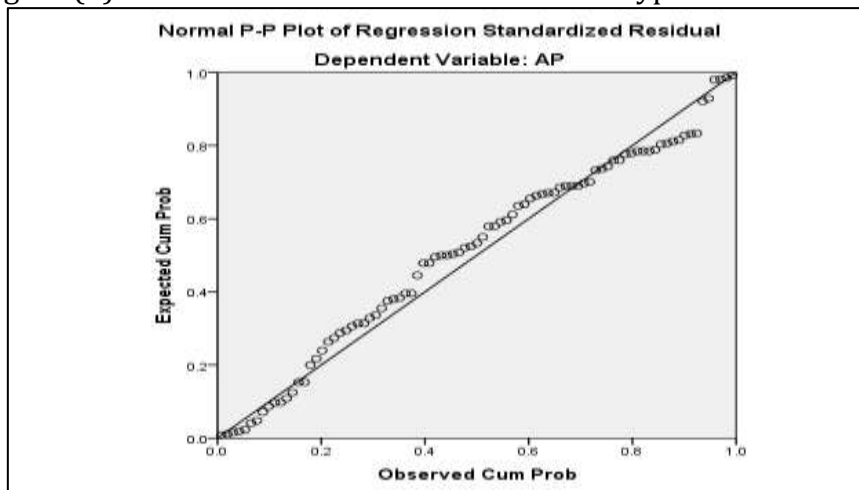


The following figure shows the fulfillment of the regression analysis test conditions graphically,

which shows the distribution of points around the straight line, and this proves that the

statistical residuals follow the normal distribution.

Figure (3) The normal distribution of the main hypothesis residuals



The first sub-hypothesis: - "There is a statistically significant effect of the use of fuzzy logic in the auditing procedures of correlation and preliminary planning." To test this hypothesis, the following "linear regression" model was formulated:

$$P \text{ \& PP} = B_0 + B_1 \text{ FLOG} + \varepsilon$$

And using the SPSS statistical program, the results were as follows:

Table (5) summary of the first sub-hypothesis test form

Model Summary ^b				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.292 ^a	.085	.075	.48021
a. Predictors: (Constant), FIOG				
b. Dependent Variable: P&PP				

The above table shows a model summary that the correlation value (R) between the variables was 0.292, and the coefficient of determination, R Square, was 0.085, which represents the "explanatory power" of the model used. That is, the independent variable (fuzzy logic) explains

8.5% of the dependent variable. (audit procedures of correlation and preliminary planning), and that the standard deviation of the estimation error was 48021.0, which is a very low number, and the lower this type of error, the better it is statistically.

Table (6) Variance test of the first sub-hypothesis

ANOVA						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1.828	1	1.828	7.927	.006
	Residual	19.601	85	.231		
	Total	21.429	86			

The table above shows the above variation anova that the calculated value of F amounted to 7.927 which is greater than its tabular value calculated according to degrees of freedom df (85.1) which amounts to 3.98 at the 5% level of

significance. The significance level of the Sig test amounted to 0.006 which is less than the acceptable error value in science predetermined by 0.05, which indicates the

suitability of the statistical model used to test the hypothesis.

Table (7) coefficients of the regression function for the first sub-hypothesis

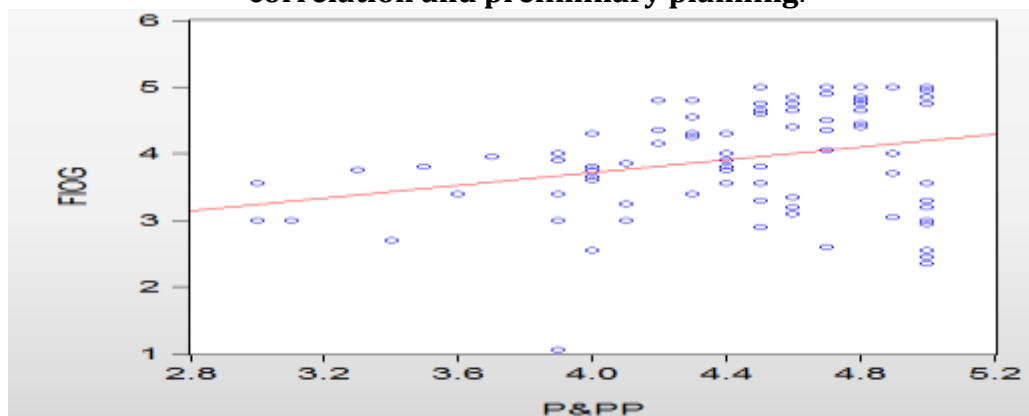
Coefficients						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.741	.254		14.754	.000
	FIOG	.178	.063	.292	2.816	.006

The table of coefficients of the regression function shows that the value of the constant of the regression equation amounted to 3.741, and that the value of the slope of the regression equation amounted to 0.178, which shows the effect of the independent variable on the dependent variable (through coefficient B), and the positive value of the coefficient indicates that there is a direct effect between the dependent and independent variables, or in the phrase Also, any increase in the independent variable (using fuzzy logic) by one degree leads to an increase of 17.8% in the dependent variable (audit procedures represented in correlation and preliminary planning) with all other independent variables remaining

constant. It is also noted from the above table that the level of significance of the T statistic for the variable The independent error amounted to 0.06, which is much less than the accepted error in social sciences, which is predetermined by 0.05, and this means that the sample data has provided convincing evidence of accepting the research hypothesis to prove the effect statistically.

The following figure confirms the relationship between the two variables through the shape of the spread, as the upward trend of the curve indicates the direct relationship between the degree of use of fuzzy logic and the audit procedures of correlation and preliminary planning.

Figure (4) the relationship between the degree of use of fuzzy logic and the audit procedures of correlation and preliminary planning.

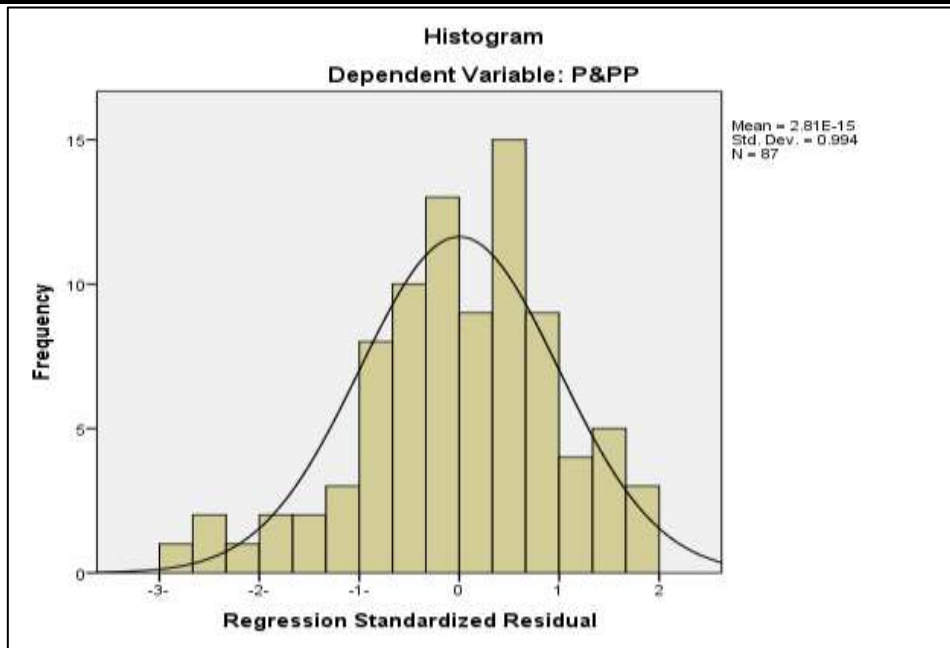


The regression equation that was adopted in testing the hypothesis can be reformulated in the light of the results that have been reached, which can be used for the purpose of prediction in the following way:

$$P \ \& \ PP = 3.741 + 0.178 * FLOG$$

The following figure displays the frequency histogram, which shows the normal distribution of the statistical residuals of the regression equation, which shows the accuracy of the previous regression equation.

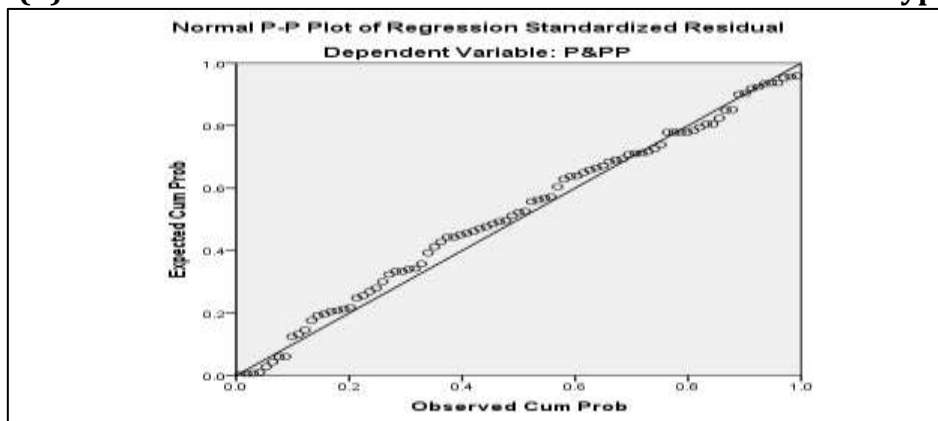
Figure (5) Histogram of the remainder of the first sub-hypothesis



The following figure shows the fulfillment of the regression analysis test conditions graphically, which shows the distribution of points around

the straight line, and this proves that the statistical residuals follow the normal distribution.

Figure (6) the normal distribution of the residuals of the first sub-hypothesis



The second sub-hypothesis: - "There is a statistically significant effect of the use of fuzzy logic in the audit procedures represented in evaluating the internal control system."

$$ICSE = B_0 + B_1FLOG + \varepsilon$$

To test this hypothesis, the following "linear regression" model was formulated:

And using the SPSS statistical program, the results were as follows:

Table (8) summary of the second sub-hypothesis test form

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.402 ^a	.162	.152	.42709
a. Predictors: (Constant), FIOG				
b. Dependent Variable: ICSE				

The above table shows the model summary, that the correlation value (R) between the variables was 0.402, and the coefficient of determination,

R Square, was 0.162, which represents the "explanatory power" of the model used. That is, the independent variable (fuzzy logic) explains

16.2% of the dependent variable. (audit procedures represented in evaluating the internal control system), and that the standard

deviation of the Estimate error was 42709.0, which is a very low number, and the lower this type of error, the better it is statistically.

Table (9) the variance of testing the second sub-hypothesis

ANOVA						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2.992	1	2.992	16.403	.000
	Residual	15.505	85	.182		
	Total	18.497	86			

The table above shows the above variation anova that the calculated value of F amounted to 16.403 which is greater than its tabular value calculated according to degrees of freedom df (85.1) which amounts to 3.98 at the 5% level of significance. The significance level of the Sig test

amounted to 0.000 which is less than the acceptable error value in science predetermined by 0.05, which indicates the suitability of the statistical model used to test the hypothesis.

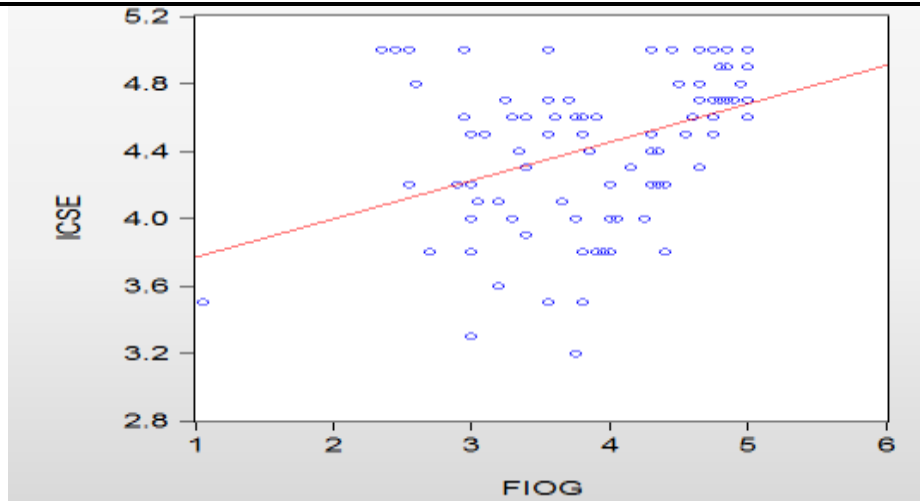
Table (10) coefficients of the regression function for the second sub-hypothesis

		Unstandardized Coefficients		Standardized Coefficients		
		a	Std. Error	Beta	t	Sig.
1	(Constant)	3.540	.226		15.698	.000
	FIOG	.228	.056	.402	4.050	.000

The table of coefficients of the regression function shows that the value of the constant of the regression equation was 3.540, and that the value of the slope of the regression equation was 0.228, which shows the influence of the independent variable on the dependent variable (through coefficient B), and the positive value of the coefficient indicates that there is a direct effect between the dependent and independent variables, or in the phrase Also, any increase in the independent variable (using fuzzy logic) by one degree leads to an increase of 22.8% in the dependent variable (audit procedures represented in evaluating the internal control system) with all other independent variables remaining constant. It is also noted from the

above table that the level of significance of the T statistic For the independent variable, it amounted to 0.00, which is much less than the accepted error in social sciences, which is predetermined by 0.05, and this means that the sample data has provided convincing evidence of accepting the research hypothesis to prove the effect statistically.

The following figure confirms the relationship between the two variables through the shape of the spread, as the upward trend of the curve indicates the positive relationship between the degree of using fuzzy logic and the audit procedures represented in evaluating the internal control system

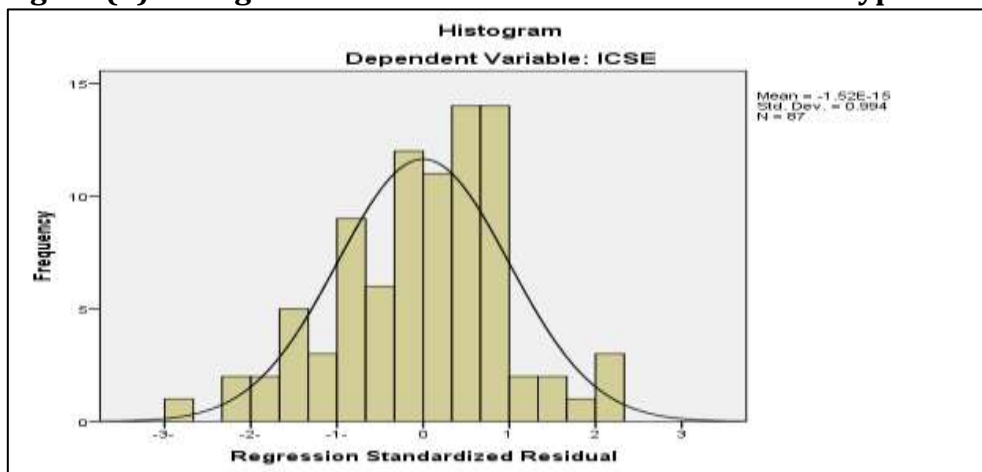


The regression equation that was adopted in testing the hypothesis can be reformulated in the light of the results that have been reached, which can be used for the purpose of prediction in the following way:

$$ICSE = 3.549 + 0.228 * FIOG$$

The following figure displays the frequency histogram, which shows the normal distribution of the statistical residuals of the regression equation, which shows the accuracy of the previous regression equation.

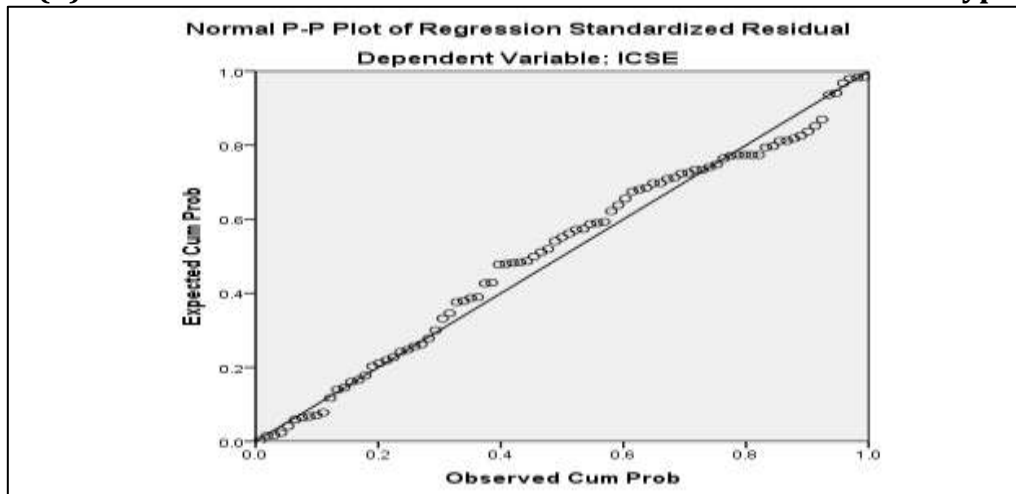
Figure (7) Histogram of the remainder of the second sub-hypothesis



The following figure shows the fulfillment of the regression analysis test conditions graphically, which shows the distribution of points around

the straight line, and this proves that the statistical residuals follow the normal distribution.

Figure (8) the normal distribution of the residuals of the second sub-hypothesis



The third sub-hypothesis: - "There is a statistically significant effect of the use of fuzzy logic in the audit procedures represented in the preparation of the audit report."

To test this hypothesis, the following "linear regression" model was formulated:

$$POAR = B_0 + B_1FLOG + \varepsilon$$

And using the SPSS statistical program, the results were as follows:

Table (11) summary of the third sub-hypothesis test form

Model Summary ^b				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.497 ^a	.247	.238	.49601
a. Predictors: (Constant), FIOG				
b. Dependent Variable: POAR				

The above table shows a model summary that the correlation value (R) between the variables was 0.497, and the coefficient of determination, R Square, was 0.247, which represents the "explanatory power" of the model used. That is, the independent variable (fuzzy logic) explains

24.7% of the dependent variable. (audit procedures represented in preparing the audit report), and that the standard deviation of the Estimate error was 49601.0, which is a very low number, and the lower this type of error, the better it is statistically.

Table (12) variance test of the third sub-hypothesis

ANOVA						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	6.865	1	6.865	27.902	.000
	Residual	20.913	85	.246		
	Total	27.777	86			

The table above shows the above

variation anova that the calculated value of F amounted to 27.902 which is greater than its tabular value calculated according to degrees of freedom df (85.1) which amounts to 3.98 at the 5% level of significance. The significance level of

the Sig test amounted to 0.000

which is less than the acceptable error value in science predetermined by 0.05, which indicates the suitability of the statistical model used to test the hypothesis

Table (13) coefficients of the regression function for the third sub-hypothesis

Coefficients ^a						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.029	.262		11.566	.000
	FIOG	.065	.065	.497	5.282	.000

The table of coefficients of the regression function shows that the value of the constant of the regression equation was 3.029, and that the value of the slope of the regression equation was 0.345, which shows the effect of the independent variable on the dependent variable (through coefficient B), and the positive value of

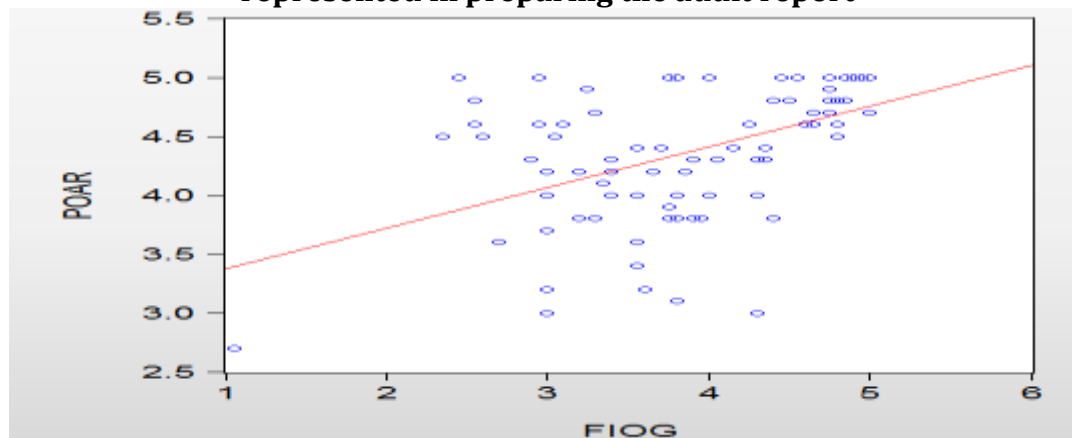
the coefficient indicates that there is a direct effect between the dependent and independent variables, or in the phrase Also, any increase in the independent variable (using fuzzy logic) by one degree leads to an increase of 34.5% in the dependent variable (audit procedures represented in preparing the audit report) with

all other independent variables remaining constant. It is also noted from the above table that the level of significance of the T statistic for the variable The independent value reached 0.00, which is much less than the accepted error in the social sciences, which is predetermined by 0.05, and this means that the sample data has provided convincing evidence of accepting the

research hypothesis to prove the effect statistically.

The following figure confirms the relationship between the two variables through the shape of the spread, as the upward trend of the curve indicates the positive relationship between the degree of using fuzzy logic and the audit procedures represented in preparing the audit report.

Figure (9) The relationship between the degree of using fuzzy logic and the audit procedures represented in preparing the audit report

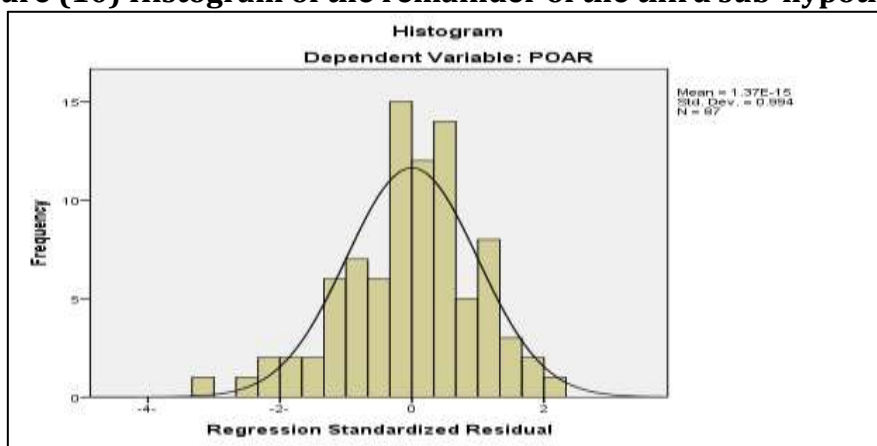


The regression equation that was adopted in testing the hypothesis can be reformulated in the light of the results that have been reached, which can be used for the purpose of prediction in the following way:

$$POAR = 3.029 + 0.345 * FLOG$$

The following figure displays the histogram, which shows the normal distribution of the statistical residuals of the regression equation, which shows the accuracy of the previous regression equation.

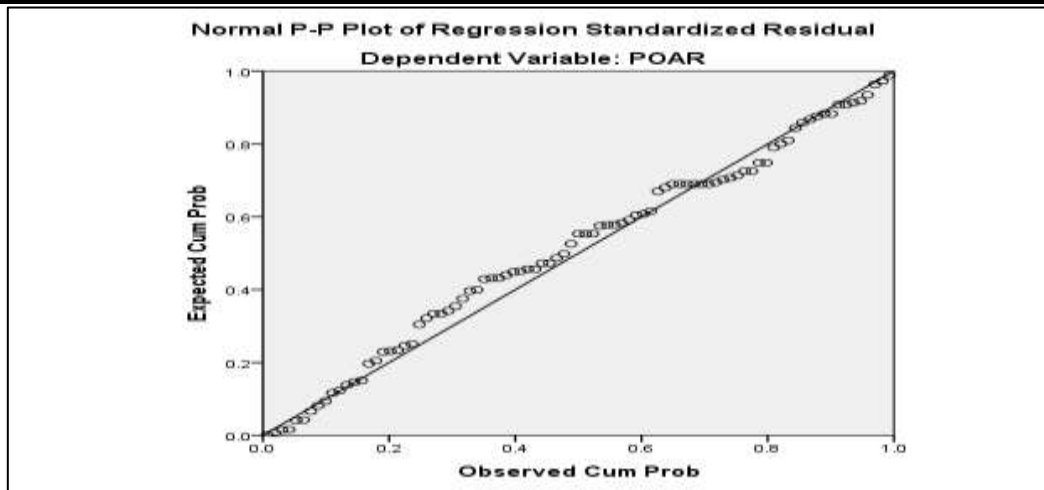
Figure (10) Histogram of the remainder of the third sub-hypothesis



The following figure shows the fulfillment of the regression analysis test conditions graphically, which shows the distribution of points around

the straight line, and this proves that the statistical residuals follow the normal distribution.

Figure (11) the normal distribution of the residuals of the second sub-hypothesis



Conclusions:

- 1- Fuzzy logic has the ability to deal with uncertain data in a systematic way.
- 2- Fuzzy logic is a good way to deal with logic that is approximate rather than exact.
- 3- The use of fuzzy logic to enhance audit procedures leads to more accurate results.

Recommendations:

- 1- Going to use fuzzy logic in units instead of classical logic because of its important role in reaching more accurate results.
- 2- Encouraging decision makers in the units to use fuzzy logic as it contributes to helping them make the right decisions.
- 3 - Educate the units on the development and progress and orientation to what is modern and new.

References

1. El Shabasy, M. S., & Mohy Sami. (2020). Developing cost, volume and profit analysis in light of the ambiguous situation of the Corona pandemic (an applied study). *Scientific Journal of Accounting Studies*, 2 (second issue), 65-109.
2. Nasreddin, Ben Masoud, & Belhreizi. (2020). Using Fuzzy Inference Technique to Evaluate the Level of Human Resources Performance - A Case Study of Sonelgaz Ain Temouchent
3. Selka, Rehab, Sayad, Mahry, Weld Hamo, & Samir/ framed. (2021). Evidence of the internal auditor and its role in supporting the external audit (Doctoral dissertation, Ahmed Derayah University - Adrar).
4. Ali, O.A.M., Ali, A.Y., & Sumait, B.S. (2015). Comparison between the effects of different types of membership functions on fuzzy logic controller performance. *International Journal*, 76, 76-83
5. Sulaiman, B.M., & Ismail, T.H. (2019). A Proposed Fuzzy Model for Predicting the Mortality Rate of Newborns Congenital Disease. *Applied Mathematical Sciences*, 13(18), 885-895
6. KONDAMIDA SHAIKSHAVALI, D.K. Asymmetrical Multilevel Inverter Using Fuzzy with Low Switching Frequency Topology With Reduced Switch Count.
7. Onyelowe, K.C., Alaneme, G.U., Onyia, M.E., Bui Van D, D.M., Nnadi, E., Ogbonna, C., ... & Onukwugha, E. (2021). Comparative modeling of strength properties of hydrated-lime activated rice-husk-ash (HARHA) modified soft soil for pavement construction purposes by artificial neural network (ANN) and fuzzy logic (FL). *Jurnal Kejuruteraan*, 33(2), 365-384
8. Chung, M.M.L. (2020). Fuzzy Logic in Clinical Decision Support Systems (Bachelor's thesis).
9. Grace, J., Mahmoud, M.A., Mahdi, M.N., & Mostafa, S.A. (2022). An Evaluation Model of Smart Manufacturing System Configurations Prior to Implementation Using Fuzzy Logic. *Applied Sciences*, 12(5), 2560
10. Iqbal, N., & Sang, J. (2021). Fuzzy logic testing approach for measuring software completeness. *Symmetry*, 13(4), 604

11. Prabu, D., Devi Prasad, B., & Lakshminarayana Prasad, K. How Fuzzy Logic can be helpful in Software Testing?
12. Cheng, S. (2022). Fuzzy Model for Credit-Linked Life Insurance
13. Rashid, C.A. (2017). The Importance of Audit Procedure in Collecting Audit Evidence/Case of Kurdistan Region/Iraq. International Journal of Social Sciences & Educational Studies, 4 (2), 15